

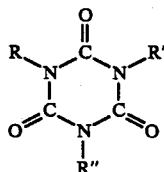
**DI-BISHYDROXYPROPYL CYANURIC ACID,
TRISUBSTITUTED DERIVATIVES THEREOF AND
A PROCESS FOR THEIR PREPARATION**

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

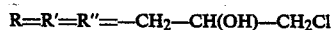
This application is related to our application entitled "DICHLOROHYDRINS OF CYANURIC ACID, TRISUBSTITUTED DERIVATIVES THEREOF AND A PROCESS FOR THEIR PREPARATION", based on French Application Ser. No. 86/17329, filed Dec. 11, 1986 [Attorney's Docket No. CDF 63], this application being incorporated by reference herein.

The present invention relates to new derivatives of cyanuric acid which are 1,3-bis(dihydroxypropyl) isocyanurate, trisubstituted derivatives of cyanuric acid, and a process for their manufacture.

Many organic derivatives of cyanuric acid are known. These are triazine derivatives substituted on nitrogen of formula:



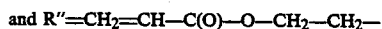
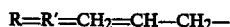
Among the known derivatives of cyanuric acid there may be mentioned 1,3,5-tri(3-chloro-2-hydroxypropyl) isocyanurate in which



This derivative may be employed as a reaction intermediate in the preparation of triglycidyl isocyanurate. It may be obtained by the reaction of cyanuric acid, formalin and epichlorohydrin (Polish Patent No. 99,060/1975).

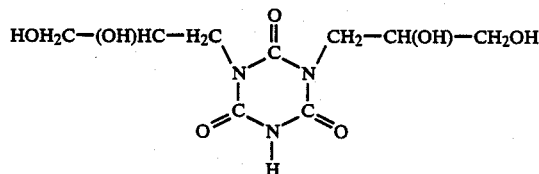
Triallyl isocyanurate, in which R, R' and R'' are $CH_2=CH-CH_2-$ radicals is also known. It is prepared by the reaction of allyl chloride with tri-sodium cyanurate. It is employed as a crosslinking agent, especially in polyesters.

Nitrogen-trisubstituted derivatives of cyanuric acid, in which the radicals R, R' and R'' are different are also known. Among these there may be mentioned diallyl monacryloyloxyethyl isocyanurate, in which:



These derivatives are described particularly in French Patent No. 2,560,874. They may be polymerized or copolymerized with acrylic monomers or may also be employed as a crosslinking agent in polymers such as polyethylenes and polystyrenes. They impart fire-resistant properties to the latter.

The first subject of the present invention is a new derivative (I) of cyanuric acid which is 1,3-bis(dihydroxypropyl) isocyanurate and is of formula:

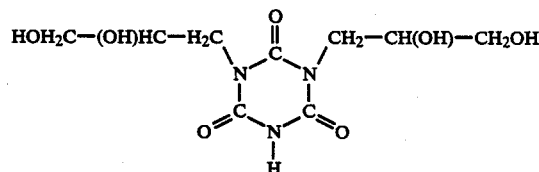


The infrared spectrum (FIG. 1) and the ^{13}C carbon magnetic resonance (^{13}C (NMR) spectrum (FIG. 2) confirm the structure of the derivative (I), namely 1,3-bis(dihydroxypropyl)-1,3,5-(1H,3H,5H)triazine-2,4,6-trione or 1,3-bis(dihydroxypropyl)isocyanurate. Its empirical formula is $C_9H_{15}N_3O_7$. Its molecular weight is 277.35. At ambient temperature it is a highly viscous and hygroscopic whitish material. It is soluble in water and in alcohols such as methanol, ethanol and propanol. On the other hand, it is insoluble in acetone, in aromatic solvents, and in ether. 1,3-Bis(dihydroxypropyl) isocyanurate (I) may be prepared in various ways. For example, it may be obtained from 1,3-di(chlorohydroxypropyl) isocyanurate by an alkaline hydrolysis reaction. A reaction medium with a pH of at least 10, preferably at least 11, obtained, for example, with the aid of aqueous sodium hydroxide or potassium hydroxide is preferably employed. The molar ratio of the basic functional groups $OH(-)$ to di(chlorohydroxypropyl) isocyanurate is at least 3.

The temperature of the reaction mixture is preferably between the ambient and $50^\circ C$. in order to avoid the hydrolysis reaction of the cyanuric ring.

At the end of reaction, 1,3-bis(dihydroxypropyl) isocyanurate is recovered by extraction with epichlorohydrin, ethanol or acetonitrile.

The second subject of the present invention is the trisubstituted derivatives (II) of cyanuric acid which may be obtained from 1,3-bis(dihydroxypropyl) isocyanurate and which have the formula:



in which R is an alkyl group containing a polymerizable ethylenic functional group such as an acrylic, methacrylic or allyl group.

The derivatives (II) according to the invention are generally colourless viscous materials which crystallize at low temperature, at about $-30^\circ C$.

The products (II) according to the invention, as well as 1,3-bis(dihydroxypropyl) isocyanurate, may be employed as crosslinking agents in polymers such as polyolefins, polyacrylics, polystyrenes, polyallyl derivatives and polycondensates such as polyesters and epoxides.

They impart properties such as good resistance to heat and to UV radiations to these polymers.

Furthermore, they make these polymers water-soluble.

The products (II) may also be polymerized or copolymerized with monomers such as (meth)acrylic monomers, allyl monomers, and ethylenic monomers such as ethylene, propylene, vinyl chloride and styrene.